In the Claims

1. (original) A mass spectrometer assembly comprising:

a base configured to define at least a portion of a vacuum chamber volume within which at least some operations may be performed with respect to mass spectrometry;

a mass separator component configured to perform at least some mass separation operations within the vacuum chamber volume; and

a lid coupled to the mass separator component and configured to be removably operably coupled with respect to the base, wherein the lid is configured to be positioned in a first operable position to form a hermetical seal with the base and provide the mass separator component at least partially within the vacuum chamber volume, and a second operable position wherein at least a portion of the lid is spaced from the base and the mass separator component is at least partially removed from the vacuum chamber volume.

2. (original) The mass spectrometer assembly of claim 1 wherein the mass separator component comprises an entirety of the mass separator.

3. (original) The mass spectrometer assembly of claim 1 wherein an entirety of the mass separator component is within the vacuum chamber volume.

4. (original) The mass spectrometer assembly of claim 1 wherein the mass separator component is entirely removed from the vacuum chamber volume with the lid positioned in the second operating position.

5. (original) The mass spectrometer assembly of claim 1 wherein an entirety of the lid is spaced from the base with the lid in the second operable position.

6. (original) The mass spectrometer assembly of claim 1 wherein the mass separator component comprises at least one focusing lens.

7. (original) The mass spectrometer assembly of claim 1 wherein the mass separator component comprises an ion trap.

8. (original) The mass spectrometer assembly of claim 1 wherein the mass separator component comprises focusing lenses and an ion trap.

9. (original) The mass spectrometer assembly of claim 1 wherein the lid further comprises an opening configured to receive at least one electrical connection configured to connect to the mass separator component.

10. (original) The mass spectrometer assembly of claim 1 wherein the lid further comprises an opening configured to introduce a sample to the vacuum chamber volume.

11. (original) The mass spectrometer assembly of claim 1 wherein the lid further comprises an opening configured to introduce ions to the vacuum chamber volume.

12. (original) The mass spectrometer assembly of claim 1 further comprising an external component coupled to the lid and configured to perform at least one operation with respect to mass spectrometry.

13. (original) The mass spectrometer assembly of claim 12 wherein the external component comprises an ion source.

14. (original) The mass spectrometer assembly of claim 12 wherein the external component comprises a plurality of ion sources.

15. (original) The mass spectrometer assembly of claim 14 wherein one of the plurality of ion sources comprises an electron impact ion source and another of the plurality of ion sources comprises a chemical ionization ion source.

16. (original) The mass spectrometer assembly of claim 12 wherein the external component comprises an inlet component.

17. (original) The mass spectrometer assembly of claim 12 wherein the external component comprises both an inlet component and an ion source component.

18. (original) A mass spectrometry vacuum chamber lid assembly comprising:

a body;

a mass separator component coupled to the body and configured to perform at least some operations with respect to mass separation for use during mass spectrometry; and

wherein the body is configured to at least partially define a volume at least partially surrounding the mass separator component when the body is hermetically sealed to a base of a vacuum chamber assembly, wherein the body is further configured to be removable from the base to at least partially remove the mass separator component from the vacuum chamber volume.

19. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 wherein the mass separator component comprises at least one focusing lens.

20. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 wherein the mass separator component comprises an ion trap.

21. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 further comprising a sample inlet component coupled to the body.

22. (original) The mass spectrometry vacuum chamber lid assembly of claim 21 wherein the sample inlet component comprises a semi-permeable membrane.

23. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 further comprising an ion source component coupled to the body.

24. (original) The mass spectrometry vacuum chamber lid assembly of claim 23 wherein the body comprises an exterior surface and the ion source component is coupled to the exterior surface.

25. (original) The mass spectrometry vacuum chamber lid assembly of claim 24 wherein the body further comprises an opening providing fluid communication between the ion source and the vacuum chamber volume and at least a portion of the sample inlet component is located between the opening and the mass separator component.

26. (original) The mass spectrometry vacuum chamber lid assembly of claim 24 wherein the body further comprises a first opening providing fluid communication between the ion source component and the mass separator component.

27. (original) The mass spectrometry vacuum chamber lid assembly of claim 26 wherein the body further comprises a second opening providing fluid communication between the first opening and outside the vacuum chamber volume.

28. (original) The mass spectrometry vacuum chamber lid assembly of claim 27 wherein the body comprises at least one edge extending between exterior and interior surfaces and the second opening extends between the edge and the first opening, wherein the second opening is configured to provide one or more of reagent gas, sample, make up gas, and vacuum to the opening.

29. (original) The mass spectrometry vacuum chamber lid assembly of claim 23 further comprising a sample inlet component coupled to an interior surface of the body.

30. (original) The mass spectrometry vacuum chamber lid assembly of claim 29 wherein at least a portion of the sample inlet component is located between the interior surface and the mass separator component.

31. (original) The mass spectrometry vacuum chamber lid assembly of claim 23 wherein the ion source component is configured to be removably operably coupled with respect to the lid and configured to be positioned in a first operable position to seal with the lid and a second operable position wherein at least a portion of the ion source component is spaced from the lid.

32. (original) The mass spectrometry vacuum chamber lid assembly of claim 31 wherein the ion source is entirely removed from the lid in the second operable position.

33. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 wherein the mass separator component is configured to separate ions in a direction substantially parallel with the alignment of the interior surface of the body.

34. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 wherein the mass separator component is configured to separate ions in a direction substantially perpendicular with the alignment of the interior surface of the body.

35. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 further comprising an external component coupled to the body and configured to perform at least one operation with respect to mass spectrometry.

36. (original) The mass spectrometry vacuum chamber lid assembly of claim 18 wherein the mass separator component comprises an entirety of the mass separator.

37. (original) A mass spectrometer comprising:

a vacuum chamber housing comprising a lid and a base, wherein the lid and the base are configured to define a vacuum chamber volume, wherein the base comprises a at least one wall configured to couple with the lid, wherein the lid comprises:

an interior surface and an exterior surface;

at least one edge extending between the interior and exterior surfaces;

a first opening extending through the lid from the interior surface to the exterior surface; and

a second opening extending from the edge to the first opening;

a mass separator component coupled to the interior surface of the lid and configured to perform at least some operations with respect to mass separation for use in mass spectrometry;

an ion source component coupled to the exterior surface of the lid and configured to perform at least some operations with respect to providing ions for use in mass spectrometry, wherein the first opening provides fluid communication between the mass separator and the ion source;

wherein the lid is configured to be removably operably coupled with respect to the base and positioned in a first operable position to seal with the base and provide the mass separator component at least partially within the vacuum chamber volume, and a second operable position at least partially removed from the base to at least partially remove the mass separator component from the vacuum chamber volume; and

a vacuum source in fluid communication with the vacuum chamber volume, wherein the seal of the base and the lid is configured to maintain a vacuum within the vacuum chamber volume sufficient to perform at least some operations with respect to mass spectrometry.

38. (original) The mass spectrometry vacuum chamber lid assembly of claim 37 wherein an entirety of the mass separator component is with the vacuum chamber volume.

39. (original) The mass spectrometry vacuum chamber lid assembly of claim 37 wherein the seal comprises a hermetical seal.

40. (original) The mass spectrometry vacuum chamber lid assembly of claim 37 wherein the mass separator component is entirely removed in the second operable position.

41. (original) A mass spectrometer operational method comprising:

providing a mass spectrometry assembly comprising a base, a lid and a mass separation component configured to perform at least some operations with respect to mass spectrometry, the base and lid substantially defining a vacuum chamber volume when the lid is affixed to the base, wherein the mass separator component is coupled to the lid and occupies a portion of the vacuum chamber volume with the lid affixed to the base;

first performing mass analysis operations within the vacuum chamber volume using the mass separation component;

after the first performing, at least partially removing the lid from the base, wherein the removing of the lid also at least partially removes the mass separator component from the vacuum chamber volume;

inspecting the mass separator component with the mass separator component at least partially removed from the vacuum chamber volume;

sealing the lid and the base after the inspecting; and

second performing mass analysis operations using the mass separator component after the returning.

42. (original) The mass spectrometer operational method of claim 41 wherein the removing entirely removes the lid from the base.

43. (original) The mass spectrometer operational method of claim 41 wherein the removing entirely removes the mass separator component from the vacuum chamber volume.

44. (original) The mass spectrometer operational method of claim 41 wherein the first performing mass analysis operations further comprises fouling the mass separator component and further comprising replacing the fouled mass separator component with a clean mass separator component.

45. (original) The mass spectrometer operational method of claim 41 wherein the mass separator component comprises focusing lenses.

46. (original) The mass spectrometer operational method of claim 41 wherein the mass separator component comprises an ion trap.

47. (original) The mass spectrometer operational method of claim 41 wherein the mass separator component comprises focusing lenses and an ion trap.

48. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises a sample inlet component coupled to the lid and the sample inlet component occupies a portion of the vacuum chamber volume with the lid and base affixed.

49. (original) The mass spectrometer operational method of claim 48 wherein the sample inlet component comprises a semi-permeable membrane.

50. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises an ion source component coupled to the lid and the ion source component occupies a portion of the vacuum chamber volume with the lid affixed to the base.

51. (original) The mass spectrometer operational method of claim 50 wherein the ion source component comprises an electron impact ion source.

52. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises an ion source component coupled to the lid and a sample inlet component coupled to the lid, and wherein the ion source and sample inlet components occupy a portion of the vacuum chamber volume with the lid affixed to the base.

53. (original) The mass spectrometer operational method of claim 52 wherein the at least partially removing the lid also at least partially removes the ion source component and the sample inlet component from the vacuum chamber volume.

54. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises an ion source component coupled to the lid and the ion source component occupies a portion of the vacuum chamber volume with the lid affixed to the base, and the first performing the mass analysis comprises providing ions from the ion source to the vacuum chamber volume.

55. (original) The mass spectrometer operational method of claim 41 wherein the lid comprises an opening and the first performing the mass analysis comprises providing a chemical ionization plasma and a chemical ionization reagent gas to the vacuum chamber volume using the opening.

56. (original) The mass spectrometer operational method of claim 41 wherein the first performing the mass analysis comprises providing ions to the vacuum chamber volume through an opening extending through the lid, providing sample to vacuum chamber volume, and contacting the ions with the sample.

57. (original) The mass spectrometer operational method of claim 56 further comprising providing a first pressure within the opening and a second pressure within the vacuum chamber volume.

58. (original) The mass spectrometer operational method of claim 57 wherein the first and second pressures are the same.

59. (original) The mass spectrometer operational method of claim 57 wherein the first and second pressures are different.

60. (original) The mass spectrometer operational method of claim 56 wherein the contacting the ions with sample occurs in the opening.

61. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises an ion source component coupled to the exterior of the lid.

62. (original) The mass spectrometer operational method of claim 61 wherein the ion source component comprises a plurality of ion sources and, before the at least partially removing the lid from the base, at least partially removing one of the plurality of ion sources from the lid.

63. (original) The mass spectrometer operational method of claim 62 wherein, before the second performing, the one ion source is replaced with another ion source.

64. (original) The mass spectrometer operational method of claim 61 wherein, before the at least partially removing the lid from the base, at least partially removing the ion source component from the lid.

65. (original) The mass spectrometer operational method of claim 64 wherein, after at least partially removing the ion source component from the lid, inspecting the ion source component with the ion source component at least partially removed from the lid.

66. (original) The mass spectrometer operational method of claim 61 wherein the first performing the mass analysis further comprises fouling the ion source component, and further comprising replacing the fouled ion source component with a clean ion source component.

67. (original) The mass spectrometer operational method of claim 41 wherein the mass spectrometry assembly further comprises an external component.

68. (original) The mass spectrometer operational method of claim 67 wherein the external component comprises one or both of an ion source component and a sample inlet component.

69. (original) The mass spectrometer operational method of claim 41 wherein the mass separator component comprises an entirety of the mass separator.

70. (original) The mass spectrometer operational method of claim 67 wherein, before the second performing, exchanging the external component with another external component.

71. (original) The mass spectrometer operational method of claim 70 wherein the external component comprises an electron impact ion source and the other external component comprises a chemical ionization ion source.